Claims

Sub A1

1. An electrolytic capacitor comprising:

a metal container having an inside surface and an outside surface and functioning as a cathode of the capacitor;

a porous coating including an oxide of a metal selected from the group consisting of ruthenium, iridium, nickel, rhodium, platinum, palladium, and osmium disposed at the inside surface of the container in electrical communication with the container;

an anode selected from the group consisting of tantalum, aluminum, niobium, zirconium, and titanium disposed within the container, spaced from the porous coating, and functioning as a second terminal of the capacitor; and

an electrolyte disposed within the container in contact with the porous coating and the anode.

2. The electrolytic capacitor of claim 1 including a metal body that is electrically connected to the container and on which the porous coating is disposed.

27 ~~3.~~ The ~~electrolytic~~ capacitor of claim 26 ~~2~~ wherein the metal body is welded to the container.

4. The electrolytic capacitor of claim 1 wherein the porous coating is disposed directly on the inside surface of the container.

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3 ~~5.~~ The ~~electrolytic~~ capacitor of claim 2 ~~1~~ wherein the anode is porous sintered tantalum having an oxide coating.

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B 4. ~~6~~. The ~~electrolytic~~ capacitor of claim ~~5~~ 3 wherein the electrolyte is a sulfuric acid solution.

B 5. ~~7~~. The ~~electrolytic~~ capacitor of claim ~~1~~ 2 wherein the anode is aluminum coated with an oxide of aluminum.

6. ~~8~~. The electrode of claim ~~7~~ 5 wherein the electrolyte is an ammonium salt dissolved in glycol.

B 7. ~~9~~. The ~~electrolytic~~ capacitor of claim ~~1~~ 2 wherein the electrolyte is chosen from the group consisting of sulfuric acid, potassium hydroxide, and ammonium salts dissolved in glycol.

B 8. ~~10~~. The ~~electrolytic~~ capacitor of claim ~~1~~ 2 wherein the porous coating includes a mixture of at least one oxide chosen from the group consisting of oxides of ruthenium, iridium, nickel, rhodium, platinum, palladium, and osmium and at least one oxide chosen from the group consisting of oxides of tantalum, titanium, and zirconium.

B 9. ~~11~~. The ~~electrolytic~~ capacitor of claim ~~1~~ 2 wherein the porous coating includes a mixture of oxides of ruthenium and tantalum.

B 10. ~~12~~. The ~~electrolytic~~ capacitor of claim ~~1~~ 2 wherein the porous coating is formed by depositing a salt of the metal of the metal oxide and oxidizing the salt in air to form the porous coating.

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13. An electrolytic capacitor comprising:

a first metal body having opposed first and second surfaces and functioning as a cathode of the capacitor;

a porous coating including an oxide of a metal selected from the group consisting of ruthenium, iridium, nickel, rhodium, platinum, palladium, and osmium disposed on the first surface of the first metal body;

a second metal body;

an anode selected from the group consisting of tantalum, aluminum, niobium, zirconium, and titanium disposed on the second metal body;

an electrolyte in contact with the porous coating and the anode; and

a sealant disposed between and contacting the first and second metal bodies, sealing the electrolyte between the first and second metal bodies.

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12 ~~14~~. The ~~electrolytic~~ capacitor of claim ~~13~~ 11 wherein the electrolyte is chosen from the group consisting of sulfuric acid, potassium hydroxide, and ammonium salts dissolved in glycol.

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13 ~~15~~. The ~~electrolytic~~ capacitor of claim ~~13~~ 11 wherein the anode is porous sintered tantalum having an oxide coating.

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14 ~~16~~. The ~~electrolytic~~ capacitor of claim ~~15~~ 13 wherein the electrolyte is a sulfuric acid solution.

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15 ~~17~~. The ~~electrolytic~~ capacitor of claim ~~13~~ 11 wherein the porous coating includes a mixture of at least one oxide chosen from the group consisting of oxides of ruthenium, iridium, nickel, rhodium, plat-

inum, palladium, and osmium and at least one oxide chosen from the group consisting of oxides of tantalum, titanium, and zirconium.

~~18.~~ 14. The ~~electrolytic~~ capacitor of claim ~~13~~ 11 wherein the porous coating includes a mixture of oxides of ruthenium and tantalum.

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~~19.~~ 17 The electrolytic capacitor of claim ~~13~~ 16 including electrically insulating spacing means disposed between the porous coating and the tantalum electrode for preventing direct contact between the porous coating and the tantalum electrode.

~~20.~~ 18. The ~~electrolytic~~ capacitor of claim ~~19~~ 17 wherein the spacing means is a material selected from the group consisting of polyolefin, polyethylene, and polypropylene.

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~~21.~~ 19. The ~~electrolytic~~ capacitor of claim ~~19~~ 17 wherein the spacing means comprises a plurality of spaced apart masses of an electrically insulating material that is stable in the electrolyte, the masses being disposed on the porous coating.

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~~22.~~ 20. The ~~electrolytic~~ capacitor of claim ~~13~~ 11 wherein the sealant is a hot melt polyolefin.

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~~23.~~ 21. The ~~electrolytic~~ capacitor of claim ~~13~~ 11 wherein the porous coating is formed by depositing a salt of the metal of the metal oxide on the first metal body and oxidizing the salt in air to form the porous coating.

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24. An electrolytic capacitor comprising:

a plurality of electrolytic capacitor cells, each cell including:

a first metal body having opposed first and second surfaces;

a porous coating including an oxide of a metal selected from the group consisting of ruthenium, iridium, nickel, rhodium, platinum, palladium, and osmium disposed on the first surface of said first metal body as a cathode;

an anode selected from the group consisting of tantalum, aluminum, niobium, zirconium, and titanium disposed on the second surface of the first metal body; and

spacing means disposed between the porous coating and the anode for preventing direct contact between the porous coating and the anode wherein the plurality of electrolytic capacitor cells are disposed in a serial arrangement with the porous coating of one first metal body being disposed opposite the anode of the next adjacent first metal body in the serial arrangement with the spacing means disposed between, separating, and preventing direct contact between the opposed porous coatings and the anodes in the serial arrangement;

a second metal body having first and second opposed surfaces disposed at one end of the serial arrangement and including a porous coating including an oxide of a metal selected from the group consisting of ruthenium, iridium, nickel, rhodium, platinum, palladium, and osmium disposed on one side of the second metal body and opposite an anode of a first metal body in the serial arrangement, but no anode, and functioning as a cathode of the electrolytic capacitor;

a third metal body having first and second opposed surfaces and disposed at the other end of the serial arrangement and including an anode selected from the group consisting of tantalum, aluminum, niobium, zirconium, and titanium disposed on one side of the third metal body and opposite a porous coating of a first metal body in the serial arrangement, but no porous coating, and functioning as an anode of the electrolytic capacitor;

an electrolyte disposed between and contacting the opposed porous coatings and the tantalum electrodes in the serial arrangement; and

a sealant disposed between and contacting adjacent metal bodies in the serial arrangement, sealing the electrolyte within the capacitor and between adjacent metal bodies.

B 29 ~~25~~. The ~~electrolytic~~ capacitor of claim ~~24~~ 28 wherein the electrolyte is chosen from the group consisting of sulfuric acid, potassium hydroxide, and ammonium salts dissolved in glycol.

B 26. The ~~electrolytic~~ capacitor of claim 24 wherein each anode is a porous sintered tantalum body coated with an oxide of tantalum.

B 27. The ~~electrolytic~~ capacitor of claim 26 wherein the electrolyte is a sulfuric acid solution.

B 30 ~~28~~. The ~~electrolytic~~ capacitor of claim ~~24~~ 28 wherein the porous coating includes a mixture of at least one oxide chosen from the group consisting of oxides of ruthenium, iridium, nickel, rhodium, platinum, palladium, and osmium and at least one oxide chosen from the group consisting of oxides of tanta-

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lum, titanium, and zirconium.

~~29. The electrolytic capacitor of claim 24 wherein the porous coating includes a mixture of oxides of ruthenium and tantalum.~~

B 31 ~~30.~~ The ~~electrolytic~~ capacitor of claim ~~24~~ 28 wherein the spacing means is a material selected from the group consisting of polyolefin, polyethylene, polypropylene, glass fiber paper, and an ion-permeable membrane.

B 32 ~~31.~~ The ~~electrolytic~~ capacitor of claim ~~24~~ 28 wherein the spacing means comprises a plurality of spaced apart masses of an electrically insulating material that is stable in the electrolyte.

B 33 ~~32.~~ The ~~electrolytic~~ capacitor of claim ~~24~~ 28 wherein the sealant is a hot melt polyolefin.

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~~33. The electrolytic capacitor of claim 24 including means for electrically interconnecting said first, second, and third metal bodies in series.~~

~~34. The electrolytic capacitor of claim 33 wherein said means for electrically interconnecting comprises an electrically conductive material disposed within the sealant and contacting the first, second, and third metal bodies.~~

~~35. The electrolytic capacitor of claim 33 including an electrically conductive film disposed on the sealant and contacting the first, second, and third metal bodies.~~

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~~36. The electrolytic capacitor of claim 24 wherein the porous coating is formed by depositing a salt of the metal of the metal oxide on the first and second metal bodies and oxidizing the salt in air to form the porous coating.~~

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